

Australia Internet Performance Index

Summary Findings 2008 (Q4)



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Executive Summary

Since 2000 Epiteiro has maintained ongoing monitoring of top internet service providers (ISP) around the world for the purpose of providing industry bodies with actual customer experience data of broadband services. In 2008 Epiteiro established broadband monitoring infrastructure in Australia, to complement the software agents it had been running since 2003, and commenced monitoring urban fixed broadband performance.

This report reviews ADSL and ADSL2+ broadband performance in Sydney, Melbourne and Brisbane, and aims to convey the findings from both customer and technical perspectives. Insight into the performance levels of popular broadband uses such as web surfing, VoIP, internet gaming and streaming video were the drivers behind the technical aspects measured.

Performance measurements were conducted using Epiteiro's ISP-ITM network of 3,600 automated 'customer experience' hardware and software agents that connect to the internet and perform automated test routines. The dataset used for this report was based on over 6 million tests from Oct 2008 to December 2008. The testing process remains active.

Key findings include the following:

- Australians receive on average 65.5% of advertised package speeds when downloading TCP data from national sources. ADSL2+ packages achieved an average 53.7% of package speed. TCP download performance is considerably worse (14.5% on average) from international endpoints.
- Downloading Web pages from locations external to Australia is much slower than most countries Epiteiro monitors
- Faster (ADSL2+) broadband services do not deliver proportionately faster web browsing speeds than slower (ADSL) services

- International Ping times (USA, UK, Japan) for all ISPs exceed the recommended 100msec limits for gaming, VoIP, video streaming and other interactive applications
- The Overall Ranking of ISPs is as follows;

Rank	ISP (Previous quarter ranking in brackets)
1	Telstra (1)
2	TPG (3)
3	iiNet (2)
4	Netspace (4)
5	AAPT (7)
6	Internode (8)
7	Westnet (6)
8	Optus (5)

Due to the range in performance amongst ISPs and packages, Epiteiro recommends that consumers fully monitor the actual service levels they receive to ensure broadband services meet their requirements. Epiteiro has launched a free application that can be downloaded from www.isposure.com for consumers in Australia to chart their actual broadband service level and compare it to other ISPs in their area.

Epiteiro will continue its research into broadband performance in Australia, and will endeavor to include mobile services, cable services, comparisons to urban and rural services, and emerging femtocell (mobile phone over the internet) analysis in future reports.

Introduction

Since 2000 Epiteiro has benchmarked broadband performance and regularly published Internet Performance Index (IPI) reports that examine numerous key performance indicators (KPIs) and ranks major ISPs within their country of operation. Epiteiro provides performance data to ISPs, industry bodies and telecommunication regulators including the OECD, Ofcom, Singapore's IDA and New Zealand's Commerce Commission.

In 2008 Epiteiro expanded its area of coverage and established a network of automated reporting agents throughout Australia. Founded on Epiteiro's ISP-I™ technology that tests Internet services from the customer experience perspective, this report analyses data collected from October 2008 to December 2008 in Sydney, Melbourne and Brisbane. During this period Epiteiro's network of simulated end user devices executed broadband tests on leading ISPs and analysed the data that formed the basis of this report.

Epiteiro conducted this research analysis independently without association or partnership with any ISP, regulator or other interested party, and was not paid to conduct this research.

Scope of Testing

In the cities of Sydney, Melbourne, and Brisbane Epiteiro subscribed to residential and business ADSL/ADSL 2+ broadband services. Broadband accounts were established by the usual customer process and ISPs were not forewarned that the accounts would be used for testing purposes. No changes were made or requested regarding the operation of the broadband package provided by the ISP.

Epiteiro test devices, simulating real residential customer activities, connected to the internet via the ISPs every 30 minutes and executed a series of tests to measure broadband performance in typical applications.

Supplementary data was collected using software agents that were randomly downloaded by the public.

ISPs Qualifying in the Research

The research project aimed to provide a general, urban-wide view of ADSL/ADSL 2+ broadband services in Australia. While cable and mobile broadband services were tested, this report concentrates on the most popular services to Australians, ADSL and ADSL 2+.

The selection of ISPs and packages was based on two criterion; i) the service needed to be available to a significant majority of the city dwellers and ii) of those ISPs, those offering the fastest advertised services were chosen. Epiteiro subscribed mainly to ADSL 2+ services though some slower ADSL services were also monitored.

The following ISPs and Packages were included in the research:

24 Mbsec: Internode Home Extreme ADSL 2+, iiNet Home 7, Netspace HM2+, Telstra Big Pond ADSL 2+, TPG ADSL 2+

8 Mbsec: Optusnet

1.5 Mbsec: Westnet Action Option 5, Netspace 1500, TPG Ultimate 1500, AAPT Bus 20

Why Measure Internet Performance?

Governments across the globe have linked broadband performance quality to social and economic development. Claims by numerous research bodies endorse the importance of high-performing broadband services.

- An Australian report has linked broadband with ecology and the environment. A recent study forecasts the social patterns fostered by improved broadband in that country could cut greenhouse gas emissions by almost five per cent by 2015 and deliver up to \$6.6 billion a year in financial savings for Australian businesses and households. The report predicted a reduction in Australia's carbon emissions by 4.9 per cent or around 27 million carbon tonnes per year by 2015. This is equivalent to the annual emissions caused by nearly two-thirds of Australia's passenger cars⁶.
- Research from the OECD (Organization for Economic Co-operative Development) claims broadband enables the "emergence of new business models, new processes, new inventions, new and improved goods and services and it increases competitiveness and flexibility in the economy¹."
- In Ireland, Forfas states that the key issue from an enterprise development perspective is the limited range and speed of broadband services available and their comparatively higher cost². The importance of a competitive, high-performing broadband service for consumers, business and government is a key message in the Telecommunications and Internet Federations' (TIF) Principles to Inform the Development of Next Generation Networks and Services, where eight (8) guiding principles are discussed at length³.
- A report prepared for the U.S. Department of Commerce concluded job growth rate levels are significantly higher in communities with superior broadband services⁴. Further research indicates that the benefits of broadband reach beyond business. Broadband technologies offer a substantial opportunity to improve the way academic education and research programs are delivered, according to a University of California study into the role of distributed broadband networks in biomedical research and education⁵.

Whilst there is much data available on general coverage and pricing, Epiteiro measures consumer and business broadband service levels as they are actually delivered to customers. With both global and national entities endorsing the need for widespread broadband services, measurement of those services is essential.

Methodology

Data Gathering

The data is collected and managed via Epitiro's ISP-ITM service. The ISP-ITM platform consists of a centralised database and reporting system along with deployments of ISP-ITM configured PCs or 'satellite agents', 'software agents' and 'hardware agents' that collect performance data of monitored network services. Testing is maintained 24x7 from Epitiro's Network Operating Centre.

ISP-ITM satellite agents are computers designed to automatically connect to the internet and run tests via a subscribed broadband connection. The specification of the computer is typical of one available for home use. ISP-ITM satellite agents use the same underlying mechanisms as an end user connecting to the internet and to the services made available via their ISP. The satellite agents are housed in a controlled environment in the target cities.

ISP-ITM hardware agents are installed in residential homes and connect to end user modems to conduct active broadband tests on a 24x7 basis. These are not currently present in Australia.

ISP-ITM software agents report performance measurements and also inform end users of their network performance. ISP-ITM software agents are downloaded randomly by the general public from www.isposure.com (see About Isposure) and are active whenever the user is on-line. Being a software application, this monitoring agent can be easily extended to rural and remote users.

All agents report the results of numerous test metrics to Epitiro's central database.

With the three methods of collecting actual broadband performance data Epitiro is able to analyse broadband services thoroughly in terms of accuracy and scope.

Data Processing and Analysis

The data is first qualified with attention to unusual findings of metrics that are then individually analysed and vetted for accuracy. The validated database formed the basis for this report.

The period of analysis in this case represents data from October to December 2008, with the test apparatus operating continuously 24x7 and performing tests at regular intervals. Over 6 million tests were conducted.

Overall rankings are based on data presented in the report plus consideration of other metrics, such as Synchronisation Speed, Email Delivery Time and Connection Failures, not specifically covered in this report.

Addressing Unfair Advantage of the Incumbent Telco

Epitiro takes steps to ensure national telcos, which may own internet infrastructure and peering points, do not receive an unfair advantage in test scores.

Where possible, Epitiro strives to ensure tests are conducted on each ISP's network rather than connecting to a common server on the national telco's network. Tests such as HTTP throughput, Latency (Ping), DNS Lookup, Email Delivery and Packet Loss are focused on either the specific service being measured or entirely off-net.

For line-speed testing (throughput and percentage of theoretical maximum) which do require termination on a server, Epitiro uses in-country endpoints connected via a major reseller that leases well-peered services across many ISPs. Epitiro also tests to its servers in the UK (Telehouse INEX, London docklands) to ensure an international view of line-speed is considered.

End User Experience in Context

The recent 2008 Traffic Analysis⁷ report from Sandvine reveals P2P files comprise 35.5% of all traffic, followed by web browsing at 32% and streaming at 18%.

However, browsing, e-commerce, emailing and other non-downloading activities still represent the highest proportion of user-invoked tasks, according to the Ofcom UK Communications Market Review 2008⁸.

Consequently Eptiro structured this report on metrics indicative of five popular tasks;

Web Browsing (Surfing the Net)

The web browsing quality of experience is generally associated with the time it takes to locate and download a web page within a web browser application. The speed or bandwidth of a customer's connection is one factor that contributes to the overall experience. In this report Eptiro examines underlying aspects such as TCP Throughput speeds, cached and non-cached HTTP download speeds and DNS Server resolution times.

Voice over IP Telephony (VoIP)

VoIP telephony is available at various levels from free (Skype) through to paid subscription landline, to emerging femtocell unmanaged network (UMA) mobile calls. Packet Loss, a key aspect affecting IP voice is researched in this report.

IPTV/On-Line Media

End users are now running applications such as streaming of internet music, on-line radio stations and video media. Again, packet loss is one essential metric this report investigates as an indication of potential customer experience.

Gaming

Interactive gaming on the web – Xbox, Sony Playstation – allows end users around the globe to compete but relies on the internet to be responsive to player commands. Ping time is examined as a leading indicator of gaming quality of experience.

Key Performance Indicators (KPI)

Epitiro ISP-I agents perform a scripted test routine that measures, where possible

- Synchronisation speed
- TCP upload and download speed
- Cached and non-cached HTTP download performance
- DNS response times
- Ping time
- Packet Loss
- Email roundtrip time

Errors and outages that occurred during the tests were also recorded.

'Up To' Comparisons / TCP Throughput Speed

Consumers and business display a growing interest in actual download speeds achieved versus the 'up to' package speeds purchased. Epitiro measures the achieved download speeds as a percentage by recording the TCP throughput speed on Port 80. A percentage of achievement is then calculated.

Endpoints that store the data reference file to be downloaded are located in both Australia and London to provide a national and international view of Australia's network performance.

HTTP Download Speed

The HTTP download speed test indicates the rate at which an ISP can download website content. The HTTP test makes a request to the specified URL and records the time taken and the amount of data downloaded, from which the speed of the download is derived. ISP-I™ devices are also able to download the embedded content, such as images on a web page, and factor this into the speed calculations.

Epitiro selected a basket of the most frequently accessed local and international websites, in order to give a wide view of internet performance to websites hosted across Australia and the rest of the world.

Ping performance

Ping times are used to assess the responsiveness of a broadband connection, largely for the purposes of interactive gaming. A 'ping' is the time taken for an ISP-I™ device to send a request to a remote server and for that server to respond with an acknowledgement. The ping test measures network latency by sending an ICMP echo request to a specified server within each city. The time recorded by the ISP-I™ satellite is the total round trip time (in milliseconds) from the request to the echo response being received from the server. The ping test is conducted on the same basket of URLs used in the HTTP tests.

DNS Lookup Time

A DNS server takes an address readable by humans (e.g. www.google.com) and converts the address to an IP address, or a specific set of numbers which identifies a particular website. The quicker this happens, the more promptly the Internet will respond to a click on a hyperlink or resolve a web address. DNS test records the time taken (in milliseconds) to resolve a fully qualified domain name to a corresponding IP address. ISP-I™ ensures that the DNS query is performed on the DNS servers, and not returned from any local cache.

Packet Loss performance

Real-time applications such as streaming video and voice require virtually uninterrupted transmissions. However, data packets may be discarded due to traffic congestion thus affecting the experience of watching video or conversing using VoIP. This test records the average packet loss that occurs as a percentage of total data sent.

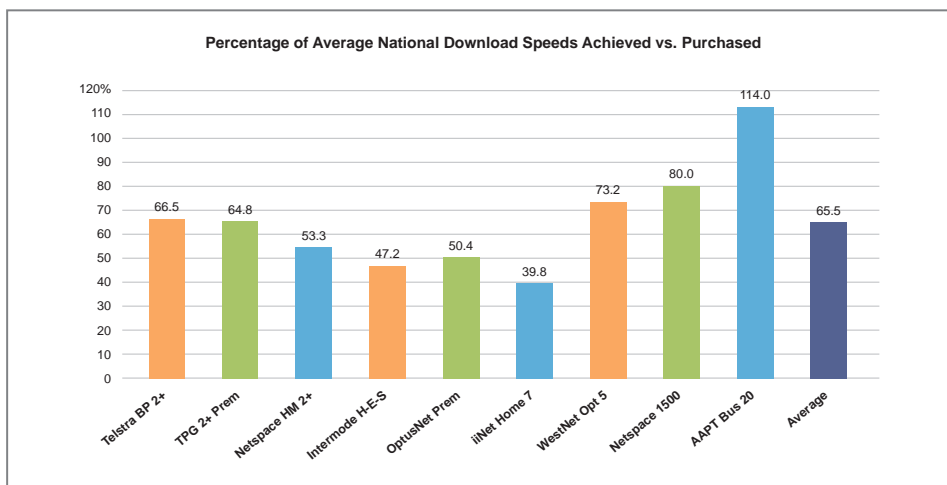
ISP Key Performance Indicator Results

TCP Download Speed – ‘Up To’ by Percentage

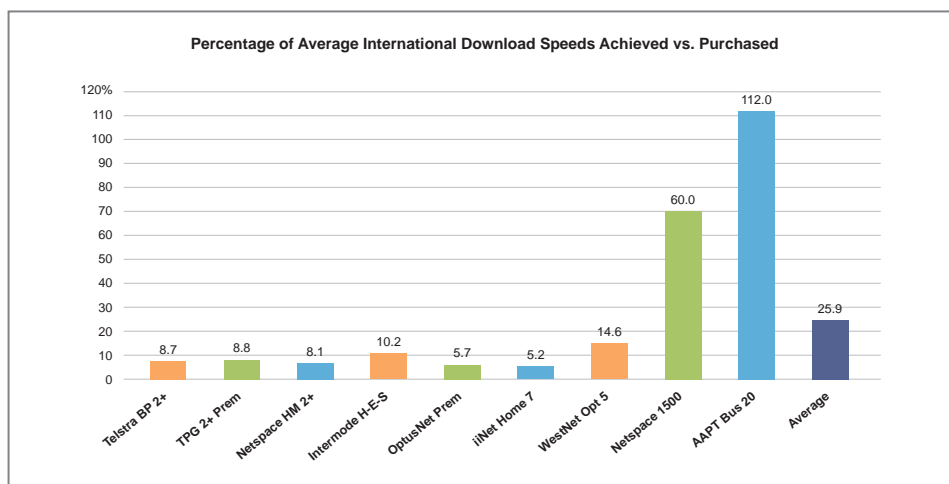
One of the growing concerns amongst broadband users is the difference in the ‘up to’ download speed advertised versus the speeds actually delivered. In DSL, cable and mobile broadband there are accepted technical challenges that impact the ability of an ISP to deliver service to the speeds advertised. That said, broadband users want to understand the actual speed or ‘bandwidth’ delivered.

Epitiro’s TCP throughput test gives the best measure of absolute maximum speed and is therefore the focal point for this section of the report.

Epitiro tested the TCP Download speeds to both national and international (UK) endpoints. An average speed over all tests (every 30 minutes) was calculated as was a maximum daily average.

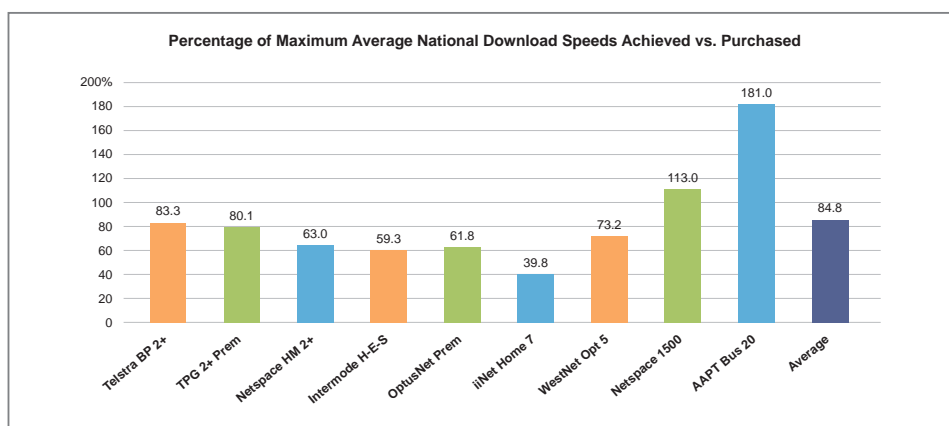


Tests results indicate that Australians receive TCP Download speeds at an average of 65.5% of their advertised package speeds. The non-ADSL2+ packages performed best in terms of percentage achieved. The ADSL2+ packages achieved only 53.7% of advertised package speed.

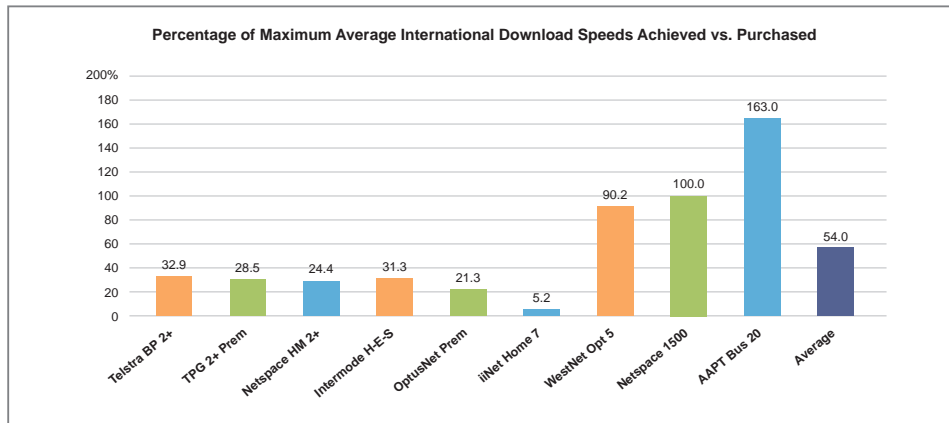


TCP download speeds from an Epitiro server in the UK revealed a significant drop in percentage achieved with an average of 25.9%. ADSL2+ services achieved only 6.8% of the advertised package speed. Results indicate that Australian broadband may struggle with overseas connectivity.

Note that AAPT Bus 20 services performed at greater than 100%.



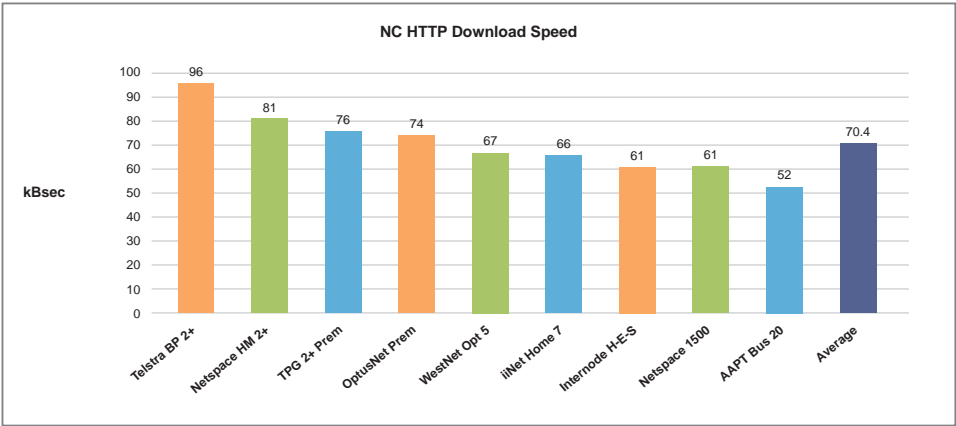
Maximum averages (best result each day) showed that ISPs can, at times, meet a much higher percentage of package speeds within the Australian network.



Maximum averages (best result each day) to Epitiro's endpoint in the UK again revealed concerning results. In terms of comparing actual speeds, there is minimal difference between the performance of ADSL2+ (24 Mbsec) services and other services.

Non-Cached HTTP Download Speed

The non-cached HTTP speed is representative of the time it takes an ISP to locate and download a website. These speeds indicate the average rate at which a basket of web pages, including images, were downloaded. Server processing times, DNS resolution time, network congestion and last mile bandwidth (sync speed) are all factors affecting HTTP download speed. Faster speeds indicate that the web page will be downloaded quickly.

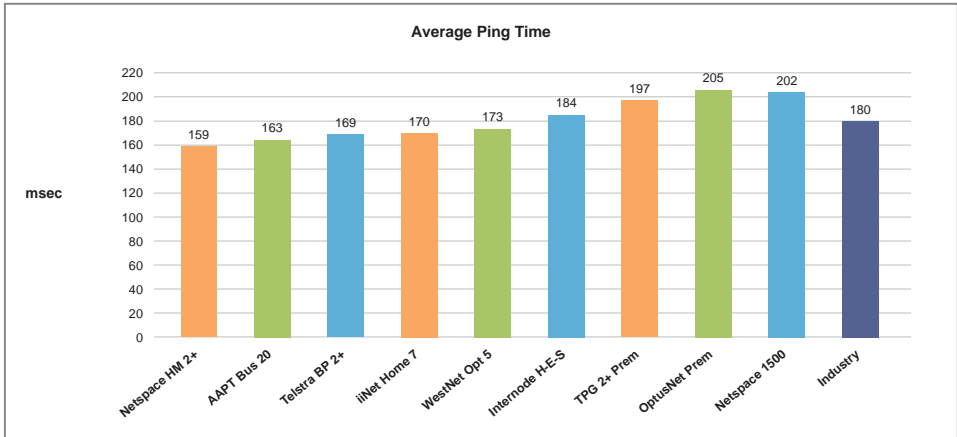


Telstra’s BP 2+ service had the fastest web surfing speeds and downloaded pages 20% faster than second place Netspace HM 2+. It is worth recalling that the test targets are all over the world and are explicitly not hosted by the incumbent. To achieve this result, Telstra provides fast speeds locally and internationally to 3rd party networks; that is, they are legitimately the fastest in this instance.

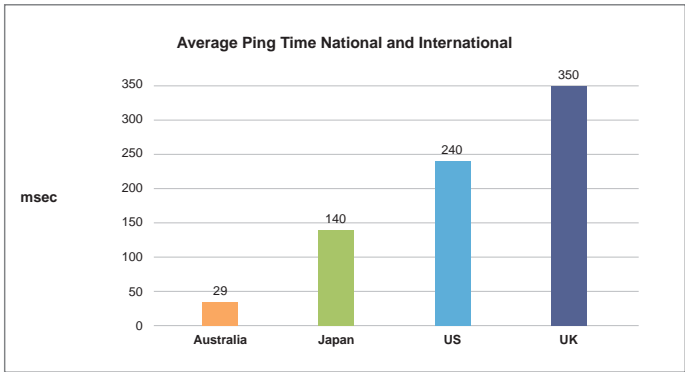
ADSL 2+ broadband packages did not consistently perform HTTP (web browsing) faster than ADSL services. Note Optus, Westnet ADSL services perform better than iiNet and Internode ADSL2+ services. The best performing service, Telstra’s 24Mbsec ADSL2+, performed better than Optus’ 8Mbsec service, though not by 3 times the speed as subscribers might expect.

Ping Time

Ping times are averaged from a series of tests to national and international servers. The average ping time for Australia is 176 milliseconds, which is well above the maximum acceptable time of 100 milliseconds that gamers use as a ceiling. This level of ping performance may also indicate lower performance of video conferencing, voice and other interactive services.



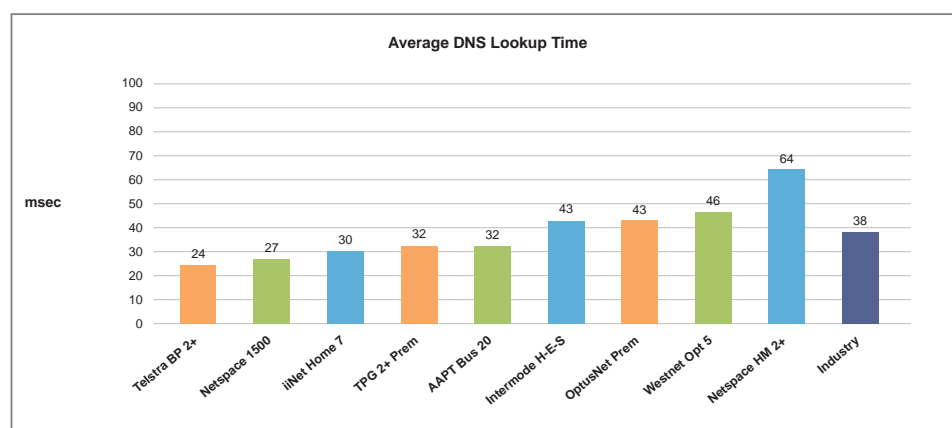
None of Australia’s ISPs showed Average Ping Times that would be considered acceptable by competitive internet game players. On closer investigation Epitiro found that ping times to national servers were quite good yet ping times to international locations were considerably slower than the maximum of 100msec recommended by gamers.



DNS Resolution Time

The ability to quickly reconcile a URL with an IP address is a factor that influences customer experience. The recently published European City Internet Performance Index (Preliminary Report) showed the average DNS lookup speed for European ISPs at 43 milliseconds with the slowest average time being 106 milliseconds by an ISP in Lisbon and the fastest being 16 milliseconds by an ISP in London.

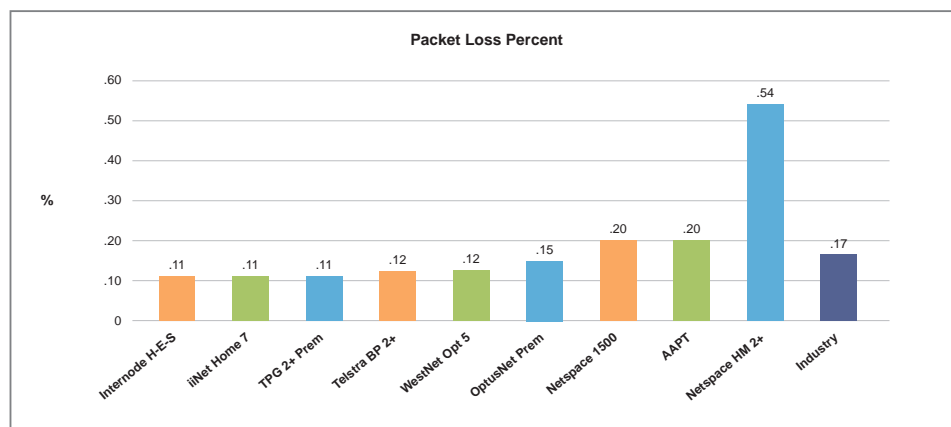
Virtually all of that time will be used in transmitting the request and response to and from the server. The actual lookup time is generally a very small fraction of the transaction.



Australian DNS Lookup times are very good in terms of individual ISP performance and overall average. Note that Netspace's 1.5Mbsec had a faster ping time than its ADSL2+ service.

Packet Loss

Packet loss is a useful indicator of network contention. When a network is under heavy load it begins first to queue packets (increasing latency), and when that is not sufficient, the last resort is to drop packets. As such, packet loss indicates a particularly busy network. Pinpointing the location at which packet loss occurs allows Eptiro to locate the weakest point in an ISP's network, be it in the last mile, local peering arrangements, or domestic or international IP transit. Packet loss is also important for user experience as it degrades the quality of streaming media and interactive voice and video, and causes a reduction in speed across all types of internet services.



With the exception of Netspace's ADSL2+ service, these packet loss statistics are in keeping with those made in the UK and Europe where the average was found to be 0.10 % in September 2008.

Packet Loss levels tend to increase with the speed of service as limiting factors such as network congestion and the quality of the infrastructure may cause issues. Typically packet loss occurs in an instant when networks are unable to cope with data traffic volumes. It is also occasionally a result of ISPs upgrading to ADSL2+, then needing to buy more upstream transit to meet the increase in demand created by a faster last mile, while experiencing packet loss in the interim.

The metric used in this report looks at total loss over a period of time. Whilst this view is conventional and a de facto standard, the stop / start 'bursty' nature of packet loss may be better expressed in the number of words dropped (VoIP) or visible judder (video).

Assuming a telephone speech rate of 200 words per minute, a typical rate according to a study from the University of Pennsylvania⁹, Netspace's ADSL2+ 0.54% packet loss would theoretically cause a drop of 1 word per minute of VoIP conversation.

Overall ISP Ranking

Based on a proprietary algorithm that considers the metrics discussed in this report (Percentage Achieved vs. Purchased TCP Throughput Speed, Non-Cached HTTP Download speed, Ping Time, DNS Lookup Time and Packet Loss) plus in consideration of other metrics measured throughout the analysis period, EpiTiro considers Telstra the best performing ISP in Australia, followed by TPG and iiNet.

Rank	ISP (Previous quarter ranking in brackets)
1	Telstra (1)
2	TPG (3)
3	iiNet (2)
4	Netspace (4)
5	AAPT (7)
6	Internode (8)
7	Westnet (6)
8	Optus (5)

Broadband Performance in Other Countries and Regions

Epitiro has recently published reports on internet performance of ISPs in other countries and regions which reflect on Australia in context. The European Preliminary Internet Performance Index comprises similar research criteria that can be directly compared.

Average HTTP download speeds to a group of ISPs in the UK was measured to be 122kBsec which is considerably higher than the 70kBsec averaged in Australia. Portugal had the slowest average speed at 45kBsec.

Across the European countries researched the average ping time was 116msec compared to Australia's average of 180msec. Every country tested in the European report had faster ping times than Australia.

Conclusions

Percentage of Speeds Achieved vs. Purchased

Most ISPs struggle to deliver ADSL 2+ services approaching the 'up to' speeds advertised, especially to destinations outside of Australia. There is a notable difference in the performance of the ADSL2+ packages Eptiro tested, in terms of 'up to' speeds achieved.

Browsing

The most indicative parameters of Web Browsing - HTTP Download speed and DNS Resolution Time – reveal that most fixed line ISPs offer good service for surfing the net. Mobile broadband has much slower times perhaps making the service less desirable and not likely in competition (technically) where fixed line broadband is available.

Gaming

With no ISPs under the 100msec preference for international servers, gaming capabilities in Australia remains a concern.

Entertainment & Communications

VoIP and media streaming appears to be possible over many ISPs, according to the low packet loss averages. However, customer experience for these real-time applications is comprised of many simultaneous factors, including Traffic Management policies that target VoIP, P2P and other bandwidth intensive traffic. Further examination will be required to draw conclusions on the actual quality of experience associated with VoIP and streaming media in Australia.

Though much more insight will be gleaned from further testing and monitoring of Australia's internet service providers, this report shows ISP service levels remain varied amongst ISPs.

Recommendations

With performance levels varying significantly Eptiro at this time suggests businesses and consumers ensure they select ISPs to meet their needs and recommends the following steps;

- Business and consumers should be familiar with the KPIs in this report for the purposes of understanding internet services
- Business and consumers should be aware of their ISP's traffic management policies as high-speed services may be reduced during peak periods for some types of traffic
- Businesses and consumers should equip themselves with suitable broadband analysis tools or sources of information such that they may make informed decisions
- Mobile and cable broadband users are advised that Eptiro will report on those services in 2009
- Eptiro recommends all interested parties remain informed of broadband service levels in their respective geographical areas

Ongoing Analysis - Rural and Urban Australia

Epitiro cautions that this report considers broadband services in urban communities only. Epitiro intends to investigate the level of broadband services in rural areas and provide comparative urban/rural reporting in 2009.

Additionally, Epitiro will strive to report on customer experience with email, VoIP, Femtocells and IPTV in future reports.

About Isposure

Epitiro collects some of its data based on software agents that are downloaded randomly by the public. The site www.isposure.com offers members of the public the means to see the average speeds over a period of time, plus compare their performance against the other ISP services available in their local area.



The data collected by the isposure application will provide an increasingly wide-spread view of broadband performance throughout Australia as presence of the application proliferates.

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About Epitiro

Epitiro is the global leader in comparative broadband benchmarking providing customer experience insight to ISPs, cellular and fixed line operators, media providers, multi-national corporations and government regulators.

Voice, video and internet performance levels are benchmarked via Epitiro's extensive deployment of ISP-I™ edge-based devices with results available through an on-line database access service or the regularly published Internet Performance Index™ report. The company also provides bespoke test and benchmarking solutions with products such as DataLite™, Vocalite™ and the Femtocell Test Suite™.

Clients such as BT, Orange, Virgin Media, Vodafone, Telecom New Zealand, Ofcom, Tiscali, KPN and many others benefit from Epitiro's coverage of fixed and wireless broadband performance.

Founded in 2000, Epitiro is based in Cardiff, Wales, UK.



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